SOCIETY OF ILLINOIS PROFESSIONAL ENGINEERS — FOUNDED 1886

the ILLINOIS ENGINEER

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS — FOUNDED 1934

Made from Kodachrome taken by H. E. Babbitt

"AULD BRIG O'DOON," AYR, SCOTLAND

(See page 1)

THE ILLINOIS ENGINEER, NOVEMBER, 1952—VOLUME XXVIII, NO. 11

Address all communications to the Society at 631 East Green St., Champaign, Illinois.

ILLINOIS SOCIETY OF PROFESSIONAL ENGINEERS, Incorporated

Affiliated with the National Society of Professional Engineers

BOARD OF DIRECTION

A. Douglas Spicer, President (68*)

R. G. Brichler, Vice President (68)
H. E. Babbitt, Secretary-Treasurer (68)

Virgil E. Gunlock, Past President (68)

John Henline, Ambraw (69)
L. K. Crawford, Capital (68)
J. R. Gardner, Central Illinois (68)
Wm. D. Mitchell, Champaign County (69)
H. F. Sommerschield, Chicago (68)
Robert M. Roy, DuKane (68)
J. L. Burnett, Egyptian (69)

F. L. Dunavan, Illinois Valley (69)
C. E. Rogers, Joliet (69)
C. L. Calkins, Lake County (69)
Geo. H. Shanahan, Madison County (69)
R. W. Kastner, Peoriarea (69)
John Duguid, Rockford (68)
R. H. Anderson, Rock River (68)

L. J. Keenan, St. Clair (69)
L. S. Pappmeier, West Central (68)
W. A. Oliver, N.S.P.E. Nat'l Director (68)
Geo. DeMent, N.S.P.E. Nat'l Director (68)
F. W. Edwards, I.E.C. Representative (68)
James L. Mills, Junior Representative (68)

* This refers to Annual Meeting at which present term expires.

P. E. Roberts, Assistant Secretary

ILLINOIS ENGINEERING COUNCIL REPRESENTATIVES

F. W. Edwards, Chairman; D. S. Magowan, Henry A. Riedesel, J. D. Voorhees

CHAPTER OFFICERS

Ambraw
R. B. Walters, President
John A. Hardwick, Vice President
C. P. Mathy, Secretary-Treasurer
John Henline, Chapter Representative

Capital
Leslie F. Ryburn, President
Carl E. Thunman, Vice President
Charles H. Merchant, Secretary
M. R. Golly, Treasurer
L. K. Crawford, Chapter Representative

Central Illinois
John F. Sweetnam, President
E. C. Hamill, Vice President
J. F. Nolan, Secretary-Treasurer
J. R. Gardner, Chapter Representative

Champaign County
Wyndham J. Roberts, President
B. F. Muirheid, Vice President
C. Dale Greffe, Secretary-Treasurer
Wm. D. Mitchell, Chapter Representative

Chicago
Frank W. Edwards, President
John Dolio, Vice President
K. C. Hoeglund, Secretary-Treasurer
H. F. Sommerschield, Chapter Representative

DuKane
Douglas E. Dreier, President
Waldemar A. Rakow, Vice President
G. M. Booth, Jr., Secretary-Treasurer
R. M. Roy, Chapter Representative

Egyptian
John T. Blankenship, President
Carl Hindman, Vice President
J. L. Burnett, Secretary-Treasurer
J. L. Burnett, Chapter Representative

Illinois Valley
Louis Bowman, President
E. Dean Antrobus, Vice President
Ross Waite, Secretary-Treasurer
F. L. Dunavan, Chapter Representative

Joliet
F. H. Tittsworth, President
W. S. Chaney, Vice President
W. K. Waltz, Secretary
J. Wilbert Ryan, Treasurer
C. E. Rogers, Chapter Representative

Lake County
R. G. Kramer, Vice President
Irwin R. Lietzke, Secretary-Treasurer
C. L. Calkins, Chapter Representative

Madison County
C. H. Sheppard, President
M. L. Graham, Vice President
M. B. Corlew, Secretary-Treasurer
George H. Shanahan, Chapter Representative

Peoriarea
Dwain Wallace, President
C. T. Borchelt, Vice President
C. G. Saville, Secretary-Treasurer
R. W. Kastner, Chapter Representative

Rockford
Lyle B. Porter, President
Royce E. Johnson, Vice President
Henry A. Riedesel, Secretary-Treasurer
John Duguid, Chapter Representative

Rock River
V. E. Hopper, President
H. W. Donaldson, Vice President
L. F. Holstein, Secretary-Treasurer
R. H. Anderson, Chapter Representative

St. Clair
Fred J. Meek, President
A. J. Feickert, Vice President
Manuel Garcia, Secretary-Treasurer
L. J. Keenan, Chapter Representative

West Central
C. E. Missman, President
James Morrow, Vice President
C. F. Bates, Secretary-Treasurer
L. S. Pappmeier, Chapter Representative

BOARD OF DIRECTION COMMITTEES

Executive
A. D. Spicer, R. G. Brichler, H. E. Babbitt, W. A. Oliver.

Honorary Membership
E. E. Cooper, Chairman, Wm. Haefliger, L. C. Auby, H. W. Lochner, J. H. Morgan.

Illinois Award
C. I. Burgraf (68), Chairman, Earl Rush (68), A. R. Boudinot (69), Geo. Anderson (69), G. H. Duff (70), C. J. McLean (70).

Military Affairs
J. C. Dietz, Chairman, G. D. Henning, W. B. Walraven, J. W. Briscoe, K. Hardine, James Jun, Wm. Day, Emmerson Schultz, A. Pauly, W. E. Gronberg.

SOCIETY COMMITTEES

Advertising
E. D. Quirke, Chairman, D. R. Connor, Rex McCann, B. F. Toney, C. R. Johnson, Fred R. Lamp, J. L. Tremper, Wm. B. MacDonald, Melvin Amstutz, R. F. Hollis, Allan Baird, E. M. Bastian, R. R. Hodges, L. I. Osborn.

Budget and Finance
R. G. Brichler, Chairman, A. D. Spicer, H. E. Babbitt, J. R. Gardner.

Civil Defense
C. W. Klassen, Chairman, B. P. Johnson, Carl Thunman, J. A. Askren, L. C. Auby, L. M. Keoughan, Victor H. Kasser, R. H. Newell, Burt K. Preston, Frank Kramer, R. B. Dunlap, P. Z. Horton, Jr., R. H. Anderson, L. J. Daigle, A. Pauly, C. F. Manion, Jr., W. H. Weimer.

Constitutional Amendments
George E. Ekblaw, Chairman, H. E. Babbitt, M. H. Kinch, K. C. Hoeglund, D. M. Campbell.

COMMITTEE APPOINTMENTS FOR 1952

Cooperation With Illinois Architects
Theo. W. Rust, Chairman, R. R. Hodges, Earl H. Beling, Samuel R. Todd, S. Alan Baird, Carol R. McDonald, W. DeCherrie, Carl A. Metz.

Ethics and Practice
L. K. Crawford, Chairman, E. S. Organ, W. G. Printy, G. Lorenz Miller, J. H. Morgan, Richard T. Cash, D. B. Williams, Pliny B. Brown, C. L. Calkins, C. F. Abraham, R. W. Kastner, W. H. Haefliger, A. A. Lundgren, R. C. Peppers, K. R. Bixby.

Fees and Salaries
Geo. L. DeMent, Chairman, C. L. Calkins, L. J. McGonigal, C. A. Arents, H. E. Wilson, R. M. Baxter, C. A. Koeiner, B. P. Johnson, R. W. Kastner, L. J. Woodyatt.

Legislative Action
R. W. Wallace, Chairman, G. E. Rynearson, G. R. Thatcher, R. H. Caldwell, C. K. Willett, C. E. Schmitz, C. M. Gintner, L. M. Spurling, H. A. Spafford, Carter Jenkins, Arthur Kaindl, Harry Kluge, A. R. Boudinot, W. A. Russell.

Legislative Analyzing
Dwain M. Wallace, Chairman, Chas. Roberts, F. E. Peterson, L. F. Koberlein, J. G. Cooney, Fred D. Ellis.

Membership
John A. Askren, Chairman, D. R. Connor, Sr., H. L. Brantley, C. F. Gebhardt, Wm. H. Smith, John G. Duba, W. A. Rakow, J. K. Staats, Wm. S. Chaney, Sidney Danoff, W. G. Flagg, C. T. Borchelt, Warner Johnson, C. K. Willett, E. W. Markwardt, J. R. Palmer.

Past Presidents
V. E. Gunlock, Chairman, Geo. E. Ekblaw, James Whelan.

Professional Education
M. E. Amstutz, Chairman, W. L. Everitt, R. E. Gibbs, F. W. Edwards, W. W. Wallace, A. W. Marbry, D. S. Magowan, C. E. Rogers, Dean O. W. Eshbach.

Publications
W. H. Wisely, Chairman, W. M. Isaac, L. M. Keoghan, G. L. Farnsworth, Jr.

Public Interests
H. L. Chastain, Chairman, R. J. Freund, Sidney Danoff, C. W. Goepfert, L. M. Krause, L. E. Woodman, A. W. Kerr, L. C. Domke, W. A. Hasfurther, John Dolio, W. A. Rakow.

Public Relations and Publicity
Lee I. Osborn, Chairman, Robert Lathrop, L. J. Collamore, E. O. Crawford, J. B. Stall, H. F. Sommerschield, Robert M. Roy, Dolph Hoke, L. W. Keeler, Carl Anderson, J. L. Jehle, Marvin Merritt, W. E. Gronberg, W. H. Day, R. R. Hodges.

Resolutions
F. L. Dunavan, Chairman, B. A. Scheidt, J. W. Marquardt, R. M. A. Fermier, J. H. Weber, E. W. Markwardt, John A. Fensterle.

Registration Laws
Alois W. Graf, Chairman, R. A. Toomey, D. H. McAnally, E. F. Snyder, H. W. Dorn, W. P. Monroe, C. F. Manion, Chas. Debes, H. E. Kaufman, Jos. A. Moore.

State Building Code
Wm. T. Hooper, Jr., Chairman, L. F. Wilson, J. L. Mills, John Henline, K. W. Smith, B. A. Wasil, C. L. Baylor, H. E. Bothe, C. H. Tapping, J. P. Dahlberg, Henry Penn, W. E. Weitman, J. D. Voorhees, S. Alan Baird, C. T. Morrisett, John W. Zuttermeister.

State Engineering Employees
Wilard O. Moore, Chairman, J. J. Sullivan, J. J. Fast, I. C. Bliss, Fred W. Moore, W. A. Hasfurther.

U. S. G. S. Mapping
Max Suter, Chairman, F. J. Meek, C. W. Greengard, H. O. Johnson, S. G. Cutler, J. P. Du-Four, C. C. Benedict, G. H. Dell.

Illinois Engineer: W. A. Oliver, *Editor-in-Chief;* H. E. Babbitt, *Associate Editor*

Of Professional Interest

THE ILLINOIS ENGINEER — THIS MONTH

Thanksgiving

And therefore, I, William Bradford (by the grace of God today,
And the franchise of this good people), governor of Plymouth, say—
Through virtue of vested power—ye shall gather with one accord
And hold in the month of November, thanksgiving unto the Lord.

—Margaret Junkin Preston

Cover Picture

We are indebted to Professor H. E. Babbitt for the cover picture on this issue of the ILLINOIS ENGINEER. *The cut was made from a Kodachrome taken by Secretary Babbitt while on a trip through Scotland this past summer.*

Auld Brig O'Doon near Ayr, Scotland, is a beautiful example of the art of bridge building during the fifteenth century. But it is also famous as the scene of an incident in the poem, "Tam O'Shanter", by Robert Burns.

Tam had been spending the evening at a pub in Ayr and was riding home at about midnight, somewhat the worse for wear, on his mare, Meg. As he was passing an old church yard he saw a gathering of witches and warlocks dancing to the fiddling of Old Clootie, himself and he tarried to observe them. Now due to the effects of his inebriation, Tam was less circumspect and wary than usual and at the end of the dance he had the temerity to applaud. This displeases the infernal assembly and they give chase after Maggie and her rider. Tam with "all hell" after him races for the keystone of the bridge where lies safety because witches dare not cross running water.

One, Nannie, among the pursuers was particularly vindictive in her determination to overtake the quarry. Nannie had been a local personage of questionable repute who had recently died and gone to hell or gone to hell and died, as you prefer, and may have had a score to settle with Tam. At any rate, she led all the rest and was able to catch Meg by the tail just as she was passing the keystone of the arch. And so, Maggie saved her master but lost her "ain grey tail".

But get the flavor of the poem by reading the last few lines for yourself.

Ah, Tam! Ah, Tam! thou'll get thy fairin!'
In hell they'll roast thee like a herrin!
In vain thy Kate awaits thy comin!
Kate soon will be a woefu' woman!
Now, do thy speedy utmost, Meg,
And win the key-stane of the brig;
There, at them thou thy tail may toss,
A running stream they dare na cross.

(Continued on page 3)

PRESIDENT'S MESSAGE

Addressed to Student Engineers

The Illinois Society of Professional Engineers takes great pleasure in announcing that the November issue of its monthly publication, *The* ILLINOIS ENGINEER, is being forwarded to each member of the Senior class of our Illinois engineering schools. It is to this group that I should like to address the November President's Message.

Included in this month's publication are questions from the last several examinations given by the board of examiners for registration as a Professional Engineer in the State of Illinois. It is because of the inclusion of these questions that this particular issue is being presented to you.

You who are Senior engineering students will cut your teeth in your profession within the next seven or eight months. You will be prepared with a bachelor's degree in some phase of engineering, you will have a background of engineering fundamentals, you will be woefully weak on practical application of engineering know-how, and you will have only the vaguest concepts of what constitute your *professional* responsibilities. Time will provide the cure for lack of practical experience, but unless you know a little about the professional responsibilities you must assume as an engineer, you may stumble in wayward paths for several years before discovering these professional aspects of your life's work.

In the first place, graduation from an engineering school does not make you an engineer in the eyes of the law. You have neither the experience nor the ability to undertake the responsibility of engineering operations on which the health and safety of your fellow men will depend, and so the law will not certify you as anything more than an Engineer-in-Training. In order to get such certification, you must successfully pass an examination in engineering fundamentals by a board of examiners made up of eminent professional engineers. After you have had a minimum of four years of responsible work under the supervision of a mature engineer you will be eligible to appear again before the examining board, at

CONTENTS OF THIS ISSUE

READ THE ADVERTISEMENTS

SUBSCRIPTION RATES

$2.00 per year in advance to members of the Illinois Society of Professional Engineers. $4.00 per year in advance to non-members in U.S.A. and its possessions, Canada, and Mexico. Foreign $6.00. Single copies 40c.

Published by the Illinois Society of Professional Engineers, Inc., at 631 East Green Street, Champaign, Illinois.

Entered as Second Class Matter April 27, 1949, at the Post Office, Champaign, Illinois.

which time you will be examined in the particular branch of engineering in which you are engaged. Upon successful completion of this examination, you will be given a certificate stating that you are a Registered Professional Engineer in the particular state in whch you take the examination. You do not necessarily have to take the first part of the examination ahead of the second part, but it is advisable to do so during your Senior year, or immediately thereafter, for it is easy to become rusty on some subjects in the intervening years when practical experience is limiting work to one specific field.

And so you can see that the next step is registration. Why registration? Well, there are many reasons. Under the present laws of most states (and all states have these laws) there are certain engineers, particularly in industrial work, who are not required to be registered. It is my personal opinon that within the next ten to twenty years these laws will be modified to require that all engineers in responsible charge of work be registered, whether in private practice or in industry. Moreover, one cannot make any legal claim to being a professional engineer unless one is registered as such. It is highly doubtful if any court would accept engineering testimony from one who was not a registered professional engineer. Basically, registration is the badge of your profession, and you owe it to yourself and to your profession to become registered.

As you find your place in the engineering world you will find problems that you little dreamed of in your preparatory work in school. You will find that your technical society keeps you in close contact with the technological developments of your field, and you will find that your professional society is keeping you informed concerning the economic and social matters common to engineers. It is these professional matters — the social and economic problems — which are foreign to our technical education. As time goes on you will find that the engineering world is closely connected with our entire social structure, and our responsibilities are far reaching. We therefore become vitally interested in certain legislative matters, and we quite naturally turn to our professional society as the collective voice of the engineering world. Economic matters fall in the same category, from problems of local nature to those of national stature, and we are interested in seeing that our own suggested schedules of minimum salaries and fees are adopted as we are in the matters of Federal expenditures for engineering projects under the Point Four program.

And so may I invite you to read this magazine carefully; look over the list of committees inside the front cover for an idea of the scope of work carried on by the Illinois Society of Professional Engineers; look over the list of local chapters, and feel free to call one of the officers and find out when and where they are meeting, and if you feel so inclined, drop in at the meeting. You would be more than welcome!

President's Datebook

October 9: Off to Chicago to meet with big city chapter in congenial atmosphere of Western Society Building. There's something to be said for the city chapter — everyone is a commuter and trains don't wait, so the program begins on schedule. 'Twas nice to renew old acquaintances and make new.

October 14: Journeyed to southern part of state where Madison County group entertained at Gun Club in Edwardsville. Mother Nature provided thunder and lightning accompaniment to elocution efforts, so no one had opportunity to nap. Spent night at Alton and travelled home through October's bright blue weather with gorgeous coloring of Jack Frost's paint brush much in evidence.

October 16: Dined this night with DuKane and Joliet Chapters in joint meeting at Elgin. Wonderful turnout, wonderful reception, and came away much impressed with program being undertaken in northeast section of state.

A. D. SPICER, *President, I.S.P.E.*

MESSAGE FROM JUNIOR REPRESENTATIVE, I.S.P.E.

JAMES L. MILLS, Illinois, '49, E.I.T.

To the Graduating Engineer

As you are preparing to enter the engineering profession you have no doubt been called upon already to make many decisions varying from what insurance or automobile to buy to what job or position to take. Each of these is an important part of your life and must all be carefully considered, studied and decided. Generally, however, they all concern you as an individual and the good that you personally will derive from them.

Your standing as a professional engineer, your economic status and your future in engineering are all very important, too, and can not be decided by you alone, but only by a group of engineers representing you and all other engineers.

Most of the engineering societies with which you are acquainted have been organized for technical enlightenment and achievement. The Illinois Society of Professional Engineers deals with the social and economical problems of our time. More and more engineers are coming to realize that we must participate not only in matters dealing with the technical phase of engineering but also, with the human, personal and social phase.

We have placed this magazine in your hands in an effort to acquaint you with our Society, its aims, its objectives and its importance to you and your profession. Your first concern as an engineer when leaving school should be to acquire professional standing. This Society has worked many years toward this goal. There is still

much to be done. We need young engineers more today than ever before. Young engineers need this Society.

We extend to you a cordial invitation to become one of our membership.

TRAFFIC ENGINEERING CONFERENCE

The Fifth Annual Illinois Traffic Engineering Conference will be conducted on the campus of the University of Illinois at Urbana on December 11 and 12, next. The Conference is sponsored by the Department of Civil Engineering at the University in cooperation with the Illinois Division of Highways, the Midwest Section of the Institute of Traffic Engineers, the Illinois Traffic Safety Council, and the Illinois Municipal League.

The aim of the meeting is to provide practical traffic engineering information for all persons who attend. Most of the Conference will be divided into two separate sessions to allow everyone — engineers, police officers, public officials, and others who are directly or indirectly interested in traffic operation on streets and highways — to choose the meeting which will offer the most helpful ideas for the solutions of his particular problems. Some of the sessions will be conducted as seminars, with panel discussions and question periods arranged to stimulate the thinking and participation of everyone.

A program is planned for the evening of December 11, but the Conference will be concluded about 3 P. M. on December 12, the second day, so that nearly everybody may return to their home that same day.

All municipal organizations and other groups concerned about traffic improvement are being urged to send at least one representative to the meeting.

Inquiries and requests for additional information may be addressed to R. K. Newton, Supervisor, Engineering Extension, 713½ South Wright Street, Champaign, Illinois.

LECTURES ON PRESTRESSED CONCRETE

The Department of Civil Engineering of the University of Illinois will sponsor two lectures on Prestressed Concrete by Dr. P. W. Abeles, Structural Engineer with the British Railways. Dr. Abeles is a well-known authority on prestressed concrete. He has written extensively on the subject and has been responsible for the design of numerous prestressed concrete structures on the British Railways.

The lectures will be given in Room 319, Civil Engineering Hall, Urbana, on Thursday and Friday, November 20, 21. All interested persons are invited to attend. Times and subjects of the two talks are:

Thursday, November 20, 7:30 p.m.

"Basic Features of Prestressed Concrete"

Friday, November 21, 4:00 p.m.

"Practical Applications of Prestressed Concrete"

COVER PICTURE

(Continued from page 1)

But ere the key-stane she could make,
The fient[2] a tail she had to shake
For Nannie, far before the rest,
Hard upon noble Maggie prest,
And flew at Tam wi' furious ettle;[3]
But little wist she Maggie's mettle—
Ae spring brought af her master hale,
But left behind her ain grey tail:
The carlin[4] claught her by the rump,
And left poor Maggie scarce a stump.

Now, wha this tale o' truth shall read,
Ilk man, and mother's son, take heed:
When'er to drink you are inclin'd,
Or cutty-sarks[5] run in your mind,
Think, ye may buy the jobs owre dear;
Remember Tam o'Shanter's mare.

[1] reward; [2] devil; [3] intent; [4] old woman. [5] skirts.

For those who are interested in more prosaic matters the arch has a clear span of 70 feet between springing lines, an overall length of 110 feet, and a roadway, 12 feet and 4 inches in width.

W. A. OLIVER, *Editor*

PEORIAREA HOLDS MEETING

Approximately 100 engineers, students, architects and contractors attended a prestressed concrete symposium Thursday night, October 23rd, at Bradley university sponsored by the Bradley college of engineering and the Peoriarea chapter, Illinois Society of Professional Engineers.

Five specialists discussed prestressed concrete, its methods and uses, design and construction of low-cost bridges, research and post-tensioned construction.

They were R. R. Keyes and G. Bishop, structural field representatives of Portland Cement association; J. Whitlock, Montgomery county superintendent of highways; J. H. Appleton, project supervisor of prestress research, University of Illinois; and G. H. Paris, structural and railway bureau, Portland Cement association. Slides and films were also shown.

Cities represented among persons present were Peoria, Galesburg, Kewanee, Macomb, Pekin, Canton, and Farmington.

COST OF LIVING INDEX

The correction factor to be applied to the I. S. P. E. Schedule of Minimum Fees and Salaries was 191.4 for September, 1952. The factor is based upon the U. S. Department of Labor's most recent Consumer Price Index.

68th Annual Meeting

March 26, 27 and 28, 1953

Fort Armstrong Hotel
Rock Island, Illinois

Addressed to Student Engineers by the Executive Officers of the Society

A copy of this issue of the ILLINOIS ENGINEER will be placed in the hands of each senior student in all Illinois engineering colleges. This is in accordance with the recommendation of the Committee on Professional Education.

VOX SECRETARII

P. E. Roberts, *Assistant Secretary*

To Student Engineers

One of the pleas of those who build and design curricula in engineering colleges and technical schools is that there is not enough time in four years to give their students a choice of elective subjects in non-engineering courses. During the last 12 years, the trend has been toward more specialized training and the trend has progressed so far that today there is very little time for the engineering student to select courses other than those in his own college.

One of the best ways for the engineering student to broaden his education is through extra-curricular activity. In most schools there are dramatics, politics, honorary fraternities, technical fraternities, intramural athletics, debating societies, student publications, and organized social activities. The principal drawback to most of these activities is that each one of them is time consuming to the extent that engineering students can not participate without sacrificing some of their technical study. The net result is therefore that the bulk of those participating in extra-curricular activity are from other than colleges of engineering.

However, there is one activity in which the engineering student can take an active and interesting part without sacrificing his work. He can join a Chapter of the Illinois Society of Professional Engineers. By his active participation in Society affairs, the student can do many things to supplement his engineering education. He can meet and rub elbows with members of the engineering faculty and professional engineers of note on the same social plane. He can practice his public speaking in Chapter meetings. He can write articles for the Chapter publication or the Illinois Engineer. He can keep up to date professionally by his reading of articles in the Illinois Engineer. He can broaden his acquaintance with student engineers in other fields of study. He can obtain the help of the Society's nation wide employment service. And finally, by his active participation in Society affairs, he is learning to adopt a professional attitude which is his first step toward an engineering career.

The student engineer needs and should belong to his "founder society" but he also needs and should belong to his professional society. There is no better or less expensive way ($2.00 per year) to acquire a "bed side manner" than by joining the Illinois Society of Professional Engineers and becoming active in its affairs.

THE ORGANIZATION AND OBJECTIVES OF THE NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Professor H. E. Babbitt, Secretary, I.S.P.E.

Republican in the form of its organization and democratic in its operation the National Society of Professional Engineers is a grass roots Society devoted to the welfare of the professional engineer. Our organization is republican since it is a federation of autonomous state societies, themselves composed of chapters usually comprising geographical areas but not excluding the organization of local professional groups as chapters. Representatives for the various chapters are members of the directing bodies of each State Society. These boards of direction, as they are commonly called, in turn appoint one or more national directors who control the activities and policies of the National Society. The number of directors from one State Society on the national Board of Direction is proportional to the number of individual national members in that State Society. The National Board of Direction might be compared to the United States Senate when it was composed of senators elected by State Legislatures. Our State Boards of Direction are likewise comparable to the legislature of the individual states.

Democratic principles are met when the ultimate control of an organization is in the hands of the individual member whose vote must be depended on to elect the executive officers of the organization, to elect his own representative from his own district, and to decide upon constitutional changes and other matters of constitutional policy. Under the constitution of the National Society the following officers are elected by direct vote of its members: ((a) President, (b) Vice presidents, and (c) Treasurer. Art. VII. Sect. 5, states:

> Election of officers shall be made annually by a plurality vote on individual letter ballots sent to all voting members of the National Society in good standing.

The constitution requires further that (Art. XII, Sect. 2) "proposed amendments mailed to each member . . . shall become effective only upon receiving affirmative vote of two thirds of the vote cast by members in good standing."

Control and operation of the Society is vested in its Board of Direction which (Art. VI, Sect. 2) "shall determine all questions of policy and shall administer the affairs of the National Society . . ." This type of organization and such powers are desirable and necessary to permit effective action by the Society and to avoid the

restraining ties under which a federation of societies might try to function. The N.S.P.E. Board of Direction can and does adopt certain policies and it prescribes certain actions requiring the services of a full-time executive officer, known as the Executive Director, and his staff. The Executive Director carries out the mandates of the Board of Direction to which he is alone responsible.

Meetings of the Board of Direction are normally held semi-annually. An Executive Committee of the Board acts for the Board between Board meetings and guides the Executive Director during such interims.

Standing Committees of the Society, as provided in the By-Laws are: Budget, Constitution and By-Laws, Education, Employment Practices, Ethical Practices, Inter-Society Relations, Legislative, Membership, Military Affairs, Publications, Registration, Resolutions, and Young Engineers. The By-Laws outline in detail the duties of each of these committees. The Board of Direction can, and does, appoint special committees from time to time to handle special problems as they arise, the duties of such special committees being specified at the time of their creation.

The objectives of the National Society are stated tersely in the national constitution as (Art. II, Sect. 1) "The objectives of the National Society shall be the advancement of the public welfare and the promotion of the professional, social, and economic interests of the professional engineer." Since its founding in 1934 the Society has devoted itself exclusively to these objectives and has cooperated closely with the various technical societies in the advancement of the profession. The National Society is generally recognized as the promoter and defender of the rights, privileges, and duties of the professional engineer and as the voice of the engineering profession in problems relating to the registration of professional engineers.

A REVIEW OF MEMBERSHIP STATISTICS

P. E. ROBERTS, Assistant Secretary

Is it encouraging or discouraging?
Where do we stand?

In an article entitled, "OBJECTIVES OF PROPOSED AMENDMENTS", appearing on page 8 in the October issue of the ILLINOIS ENGINEER, there is a paragraph headed *"Stagnation or Progress?"*. This paragraph discusses the membership situation in so far as I.S.P.E. is concerned. In this paragraph, there is the following sentence, "Compare this with NSPE's membership picture which shows an increase from 21,694 in 1949 to 27,454 in 1952 or 26.6%". A more complete picture, based on figures published by NSPE in its monthly membership reports, on November 30, 1949, and on August 31, 1952, shows the following:

1951 Total Membership	Mass. 900	Penna. 3082	New York 3221	Texas 1917	Illinois 974	Georgia 760
1949 Total Membership	683	2527	2720	1772	942	736
Increase	217	555	501	145	32	24
Percentage Increase	31.8	21.9	18.4	8.2	3.4	3.1

1951 Total Membership	Wis. 779	Minn. 711	New Jersey 1685	Ohio 3145	1st 10 17,174	ALL NSPE 25,177
1949 Total Membership	768	702	1722	3271	15,843	21,313
Increase	11	9	— 37	— 126	net 1331	3864
Percentage Increase	1.4	1.3	— 2.1	— 3.9	8.4	18.1

The situation has been of concern on both the National and Illinois levels; it was discussed at length at Tulsa last June, and it is now a major consideration by our State and Chapter Membership chairmen and State officers.

Almost every one who has contributed to America anything in which America is proud, has founded his life upon the teachings of the New Testament of the Bible.
—Theodore Roosevelt.

There is no such thing as a big job. Any job, regardless of size, can be broken down into small jobs, which, when done, complete the larger job.—Walter P. Chrysler.

REGISTRATION EXAMINATION QUESTIONS

The questions beginning on the opposite page were taken from examinations given for registration as professional engineer in Illinois during 1950, 1951 and 1952. They are a part of the Third Edition of a book of questions published by I.S.P.E., available for $1.00. All questions have been published from time to time in the ILLINOIS ENGINEER as a part of the permanent records of the Society.

I pity no man because he has to work. If he is worth his salt, he will work. I envy the man who has a work worth doing and does it well.—Theodore Roosevelt.

PROFESSIONAL DIRECTORY

Typical Questions

Taken from Examinations given by the State of Illinois Department of Registration and Education during 1950, 1951 and 1952.

Foreword

by C. HOBART ENGLE,
Director Department of Registration and Education. July, 1952.

The Illinois Professional Engineering Act was passed in 1945 by the Illinois Legislature to protect the public from incompetence in the practice of professional engineering.

Since the effective date of the Act (July 20, 1945) the examining committee, established by the law to advise the Department of Registration and Education in its administration, has been developing and giving examinations designed to test the qualifications of applicants for registration.

During the first few years of operation the Department released copies of examinations occasionally but no examinations have been published since 1949. As a matter of public information the Department has decided to make available typical questions that will illustrate the type of examinations being given to those who seek registration as professional engineers in the State of Illinois. The questions released at this time are not to be understood as constituting any actual examination. They have been taken, more or less at random, from examinations given during 1950, 1951 and 1952, and are merely intended to illustrate the character of examinations now being given.

Examinations cover two full days. Part I, given on the first day, is confined, in accordance with the Act, to questions which ". . . embrace the subjects required of candidates for baccalaureate degree of engineering by the College of Engineering of the University of Illinois . . . ." Part II, given the second day, is devoted to questions more professional in character and again is in accordance with the requirements of the Act that it ". . . shall be such as will establish whether or not the applicant has the professional engineering experience required by Section 9."

Certain questions given the first of each day must be answered without the use of reference material of any kind. However, during the major portion of the examinations the candidates are allowed to use reference books chosen from an authorized list issued by the Department.

In addition to the written examination the candidate for registration is required to submit evidence in the form of drawings, design calculations, reports, or other documents, that will illustrate the character of his experience and the extent of his professional responsibility.

It is not the present policy of the Department to publish actual examinations given for the registration of professional engineers. However, it is proposed to keep the public informed of the type of examinations being used through release every few years of typical questions as is being done at this time.

C. HOBART ENGLE,
Director.

FIRST DAY
(Fundamental Principles)

Morning

1. A cable supporting a uniformly distributed load hangs with one end supported at "A" in a curve, the equation of which referred to "A" as coordinate center is:

$$y = -\tfrac{3}{4} X + \frac{1}{1280} X^2$$

in which x is positive measured to the right and y is positive measured upward. The other end of the cable is supported at "B", to the right of "A", at a point where the slope of the cable is + 0.50.

(a) Calculate the coordinates of point "B".

(b) Calculate the coordinates of the low point on the curve.

(c) Calculate the slope of the curve at "A".

2. A spherical weather balloon which is to be filled with hydrogen is to be constructed and the following data are to be used for the purposes of this problem:

Weight of air = 0.077 lbs. per cu. ft.
Weight of hydrogen = 0.005 lbs. per cu. ft.
Weight of balloon sphere, basket and rigging = $(0.15 + 0.0001\ d^2)$ lbs. per sq. ft. of surface of gas sphere. d = diameter of gas sphere in feet.

(a) What diameter of gas sphere will provide a balloon having the greatest "pay load"?

(b) What "pay load" can the balloon lift?

3. A rectangular flume is to be supported by and must pass through frames having as a clearance diagram an ososceles triangle having a horizontal base of 30′ — 0″ and an altitude of 20′ — 0″.

(a) What will be the outside dimensions of the flume having the largest cross sectional area that can be passed through the frames?

(b) If the sides and bottom of the flume are 6 inches thick and the surface of the water is 6 inches below the top what will be the discharge from the flume in gallons per minute if the water flows at an average velocity of 4 feet per second.

4. A cork ball 6 feet in diameter is fastened to the bottom of a tank by a chain that is exactly 3 feet long and that may be considered to be weightless. The specific gravity of cork may be taken as 0.20 and the weight of water as 62.4 lbs. per cu. ft.

(a) At what depth of water in the tank will the chain begin to pull on the cork ball?

(b) What pull will the cork ball exert on the chain when the water in the tank is: (1) 6 feet deep; (2) 9 feet deep; (3) 12 feet deep?

5. At four cents per kilowatt-hour how much will it cost to maintain a temperature of 110 degrees for 24 hours in a box 3 feet square on each side if the outside temperature is 72 degrees and the material transmits 0.1 BTU per sq. ft. per hour per degree difference in temperature in degrees F?

6. Three steel balls, A, B, and C are identical in every respect and each weighs 100 lbs. Each ball starts from rest at elevation + 750′ at exactly the same instant. Ball A drops straight down, Ball B rolls down a smooth inclined plane having a slope of 3 vertical to 4 horizontal, and Ball C rolls down a smooth inclined plane having a slope of 1 vertical to 4 horizontal. Neglecting air resistance:

(a) How long in seconds will it take each ball to reach elevation + 510?

(b) What will be the velocity of each ball parallel to its direction of motion as it reaches elevation + 510?

7. A non-inductive resistance and an impedance coil are connected in series across a 220-volt, 60-cycle supply. The circuit draws 4.87 amperes. A voltmeter connected across the resistor reads 140 volts. When connected across the impedance, the voltmeter reads 110 volts. Determine:

(a) The impedance of the impedance coil.

(b) The power factor of the circuit.

(c) The power factor angle of the impedance coil.

(d) The resistance of the impedance coil.

(e) The inductance of the impedance coil.

(f) The power consumed by the entire circuit.

(g) Draw a vector diagram illustrating your solution.

8. Two flat bottomed cylindrical tanks, A and B, stand in a vertical position with a pipe connecting their bottoms. Tank A is 60 feet in diameter inside and its bottom is 50 feet higher than the bottom of tank B, which has an inside diameter of 10 feet and an inside height of 15 feet. The top of tank A is open to the air but tank B has a flat, air tight top in which there is a pressure gage. The pipe connecting the bottoms of the tanks has a valve at the connection to tank B.

At a given instant water stands in tank A at a depth of 20 feet above its bottom while tank B is empty with the valve in the connecting pipe closed. With the gage in the top of tank B showing 4 p.s.i. the valve in the connecting pipe is opened. If there is no change in temperature and sufficient water is added to tank A to maintain the depth at 20 feet above its bottom:

(a) How high will water rise in tank B?

(b) What will be the reading on the pressure gage in the top of tank B?

9. A cylindrical tank with flat ends has an inside diameter of 10 feet and an outside length of 20 feet. The tank is filled with dry air. At a time when it shows a gage pressure of 10 p.s.i. and a temperature of 60° F. there are pumped into the tank 100 cu. ft. of Gas A, 60 cu. ft. of Gas B, and 300 cu. ft. of Gas C, all taken from sources at atmospheric pressure and a temperature of 60 degrees F. Data for the air in the tank and the gases introduced are given in Table 1-a, 9.

TABLE 1A, 9

Gas	Approx. Mol. Wt.	Density Rel. to Air	Gas Constant
Air	29	1.000	53.3
A	44	1.520	35.0
B	28	0.970	55.3
C	4	0.137	397.0

Calculate:

(a) The weight of the air and of each gas in the tank.

(b) The equivalent molecular weight of the gas mixture.

(c) The gage pressure in the tank after the gasses are all in.

(d) The gage pressure resulting if the temperature of the gas mixture is raised to 120 degrees F.

10. A 400 horsepower engine is to be tested using water cooled brakes. At what rate must water, from a supply having a temperature of 60 degrees F. flow through the brakes if the temperature of the water is not to rise above 180° F and if 5% of the heat is dissipated through the air?

11. A gear-head motor runs at 1728 r.p.m. and has an output of 1½ horsepower through a double gear reduction of 3 to 1 ratio per step. Motor efficiency is 75%. Each gear reduction has a 3% friction loss. Calculate:

(a) Overall efficiency

(b) Output torque

(c) Watts input

12. A 100-ohm resistor and 10-microfarad capacitor are connected in series across a 100-volt d.c. supply at time $t = 0$.

(a) Find the value of the current at time $t = 0.001$ seconds after the circuit is energized.

(b) Find the value of the voltages across the capacitor and resistor at the same instant.

(c) Find the energy consumed in the resistor while charging the capacitor.

(d) Find the energy supplied to the capacitor.

13. (a) Define and illustrate: (1) chemical change, (2) physical change, (3) What is chemistry?

(b) Define and illustrate: (1) symbol, (2) formula, (3) chemical equation.

(c) (1) What is spontaneous combustion? (2) Why are metal containers used for oily cotton wastes in shops?

(d) (1) What is meant by the fixation of nitrogen?

(2) Give two chief commercial sources of combined nitrogen?

(3) Describe briefly a natural method and a commercial method for the fixation of atmospheric nitrogen.

(4) Why is the fixation of nitrogen important to a country in time of peace and in time of war?

(e) (1) Describe the chemical test for carbon dioxide gas and tell how to show that the gas is a product of ordinary burning.

(2) What properties fit carbon dioxide gas for use in: (a) beverages, (b) fire extinguishers?

(3) What is the gas causing the blue flame that often appears above a hard coal fire?

14. From the following list of gases:

Oxygen
Hydrogen
Chlorine
Ammonia
Hydrogen Sulfide
Hydrogen Chloride
Nitrogen
Nitrogen Peroxide

Select:

(a) Two gases that are denser than air.

(b) A gas that is less dense than air.

(c) Two gases that have distinctive odors.

(d) Two gases that burn in air.

(e) Two gases that are made by reacting sulfuric acid with a salt.

(f) A gas that is an acid anhydride.

FIRST DAY

Afternoon

1. A rectangular sluice gate measuring 5 ft. vertically and 8 ft. horizontally is set in the vertical face of a dam. The gate must be opened when the water reaches a level of 40 feet above its upper edge. The coefficient of friction between the gate and its guides may be taken as 0.33. What pull will be required to hoist the gate?

2. The hoist line from the gate in the preceding problem winds directly onto a drum 24 inches in diameter. The drum is to be turned by two hand cranks, with 12 inches radius, through a gear train to be selected from gears having 60 teeth and pinions having 12 teeth.

(a) Select a gear train such that two workmen turning the hand cranks will not have to exert a pressure greater than 20 pounds each if the overall efficiency of the hoisting mechanism is 80%.

(b) If the workmen can maintain an average rate of speed of 20 r.p.m. of the cranks how long will it take them to open the sluiceway?

3. A 200 horsepower, 60-cycle, 3-phase synchronous motor is operating overexcited on a 2300-volt, 60-cycle supply so that it takes a leading current of 35 amperes, and a power input of 100 kw. Determine:

(a) Total kva.

(b) Values of resistance and capacitance in each of three impedances connected in wye which would replace the motor.

(c) Repeat (b) for delta connection of the impedances.

4. An indicator card of a 4 cycle automobile engine taken with a 420 lb. spring is 3 inches long and has an area of 1.25 sq. in. If the engine has 8 cylinders, 3.6 in. diameter by 3 in. stroke and travels at 2800 r.p.m. what is the developed horsepower?

5. A member of a machine frame has the section shown in figure A5. It is subjected to a thrust that acts parallel to the longitudinal axis in the Y-Y axis at the distance 2 inches below the top, and to a pull parallel to the longitudinal axis in the Y-Y axis at a distance of 3 inches above the bottom. The maximum permissible stresses are 10,000 p.s.i. in compression and 20,000 p.s.i. in tension.

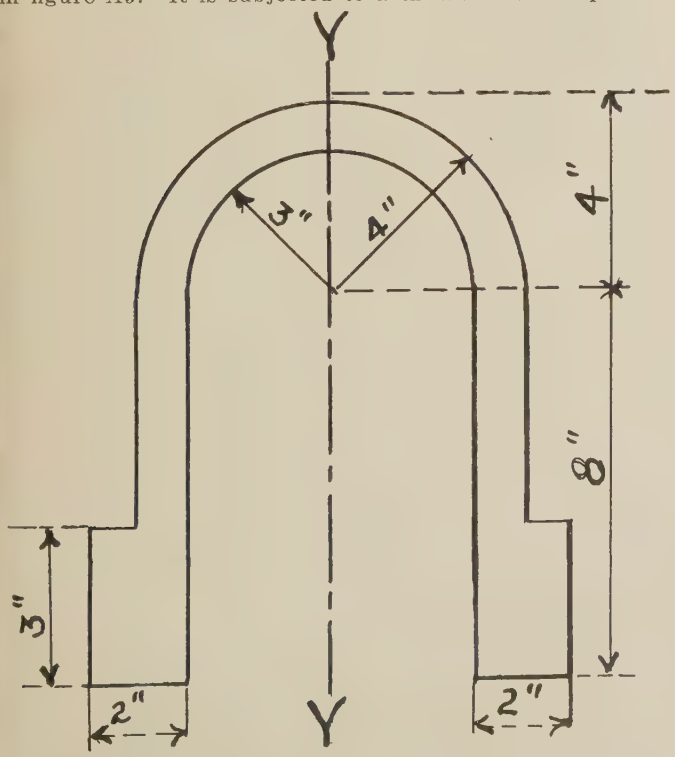


Figure A5

(a) What is the maximum thrust to which the member should be subjected?

(b) What is the maximum pull to which the member should be subjected?

6. The field of a 4 pole d.c. machine requires 4.2×10^6 maxwells per pole produced by 2.3 amperes from a 225 volt line. The coils are in series and have 2200 turns per pole.

(a) What is the self inductance of the field circuit?

(b) What is the energy stored in the field when excited?

(c) How much power is required to maintain the flux?

(d) When the circuit was closed on the 225 volt line, what was the initial rate of current increase, assuming no saturation?

(e) What voltage would be induced if the current were cut off in 1/10 sec.

(f) If a resistance of 80 ohms was connected across the field when the circuit was interrupted, what voltage would be induced?

7. A basement 100 feet by 75 feet is to be excavated in earth to a level bottom at elevation 762.3′. The B.S. on a B.M. of elevation 775.56′ is 3.96′. Rod readings taken before excavation are shown in Figure 7.

Calculate the cost of excavation at $2.25 per cu. yd.

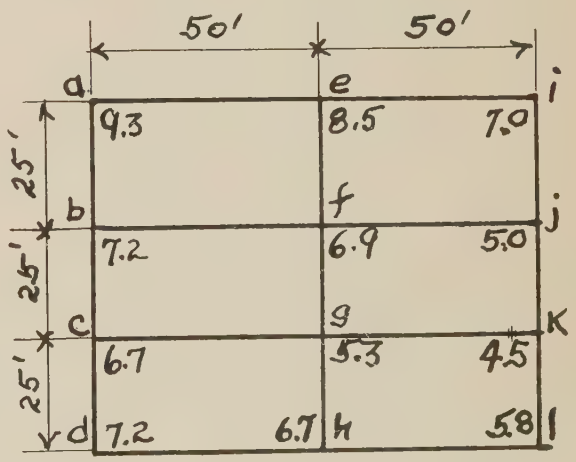


Figure 7

8. A motor rotor is mounted between bearings 6 feet center to center. The center of gravity of the rotor and shaft is 2 feet from the center of one of the bearings and 0.1 inch away from the axis of rotation. If the weight of the rotor and shaft is 750 lbs. find the maximum bearing loads when rotating at 600 r.p.m.

9. A sewer is constructed of clay tile pipe, 36 inches in diameter, and is a half mile long. The elevation of the invert of the pipe at the upper end is 13.46 feet and at the lower end is 11.22 feet. How much sewage in m.g.d. is flowing through the pipe if it flows half full?

10. An I-shaped beam is to be constructed by welding together a web plate 24″ × ¾″, a 15″ channel weighing 50 lbs. per ft. as the top flange and a plate 10″ × 1″ as the bottom flange. The beam is to be symmetrical about the center line of the plate which is to be vertical. The flanges of the channel are to be turned down.

(a) Calculate the moments of inertia about the centroidal axes.

(b) If the section is subjected to a thrust of 300,000 lbs. acting in the central plane of the beam and along a line parallel to and 3 inches below the top of the beam calculate the intensity of stress in the outer fibers of the beam.

11. A mixing tank in a chemical plant is 6 feet wide, 15 feet long, and 12 feet deep. It has a sharp edged circular orifice 4 inches in diameter in the center of one end, the center of this orifice being 6 inches above the bottom of the tank. The components of the fluid mixture (which may be assumed to flow like water) are admitted to the tank from sources that automatically shut off when the level in the mixing tank is 10 inches below the top and automatically start up when the level fails to 3 feet-6 inches above the bottom of the tank.

(a) How long will the sources of supply remain shut off?

(b) What is the average rate of discharge in gallons per minute during that time?

12. Air at 28.5 in Hg, 90° F d.b., and a relative humidity of 70% is cooled at constant pressure to 50° F. Find

(a) the relative humidity after the cooling process

(b) the change of enthalpy

(c) the change of total heat

(d) the heat removed

(e) the weight of moisture deposited per lb. of d.a. Find the original wet-bulb temperature from a psychrometric chart.

(f) The air, after having been cooled, is reheated to 73° F. d.b. What are the resulting relative humidity and the humidity ratio?

13. A rocker 8 inches long is actuated by a crank and connecting link. The center of the rocker shaft is 20 inches to the right and 5 inches above the center of the crank shaft. The rocker is to move from a vertical position through an angle of 45 degrees counterclockwise and back to its vertical position during each rotation of the crank which rotates counterclockwise.

(a) Determine the length of the connecting link and the length of the crank.

(b) If the crank rotates at a constant speed of 30 r.p.m. what is the maximum angular velocity of the rocker and in what position does it occur?

14. (a) (a) Draw a diagram of the open hearth furnace and describe the manufacture of open hearth steel. (b) Mention four metals used in small quantities to modify the qualities of steel.

(b) What is (1) clay? (2) cement? (3) concrete? What are the uses of each?

(c) What is denatured alcohol? (1) What is the object of denaturing alcohol?

(d) Explain why soap does not easily form suds with hard water.

SECOND DAY

(Professional Group, Group A through Group E.)

Group A

1. Twenty year sewer revenue bonds in the amount of $150,000 are to be sold at an interest rate of 3½%, with annual fixed charges of 7%, and a bond service charge and reserve of 28%. What revenue must be collected each year to redeem the bonds at due date?

2. A 5%, $1,000 bond, with interest paid semi-annually, matures in 12 years. For what price must it be offered on the market in order for investors to earn 6% nominal interest payable semi-annually?

3. A company buys a punch press for $12,000, which it agrees to pay in 5 equal yearly payments, beginning one year after the date of purchase, at an interest rate of 4% per annum. Immediately after the second payment, the terms of the agreement are changed to allow the balance due to be paid off in a single payment the next year. What is the yearly payment for the first two years? What is the final payment?

4. A firm is considering building an addition to its plant which it will finance through the sale of bonds. It issues 20 year bonds with a face value of $1,000,000 bearing interest of 4% payable semi-annually. The firm finds, however, that it can sell these bonds for only $900,000. What is the nominal yearly rate of interest that the firm must actually pay for the funds received?

5. A utility company which serves a small community has a steam power plant that cost $50,000 when it was built 15 years ago. Its life was estimated at 30 years and depreciation has been written off on the books on a straight-line basis assuming zero salvage value at the end of 30 years. Its net realizable value today is estimated at $1,000 and may be expected to remain at this figure the rest of its life. Total annual disbursements for operation at the present load are $17,000. A new Diesel plant to carry the same load will cost $45,000, installed and ready to operate. Its life is estimated as 15 years with a $5,000 salvage value. Total annual disbursements are estimated at $11,000.

If the minimum attractive return to the company is 7%, make annual cost computations to show whether it will pay to replace the old steam plant with the Diesel plant.

6. (a) Name the six component parts generally considered necessary to comprise a legal construction contract.

(b) If an engineer under proper classification is an agent, what is his responsibility?

Group B

1. In the preliminary planning of a large chemical plant to be located in the South, the question of design of the power plant and the type of boilers to install has arisen. Plentiful supplies of the following fuels are available, delivered at the prices indicated.

Oklahoma Coal: Price — $6.10 per ton (2000 lbs.); ultimate analysis — 80.9% carbon, 4.5% hydrogen, 1.0% sulfur, 1.8% nitrogen, 2.9% oxygen, 6.0% ash, 2.9% moisture.

Texas Fuel Oil: Price — 5.2 cents per gallon; API gravity is 12.; variation of viscosity with temperature — $\mu^{n \cdot 15} t_h = 40$.

Louisiana Natural Gas: Price — 4.1 cents per 1000 cu. ft. at 60 F. and 30 in. Mercury and saturated with water vapor; volume analysis — 70% CH_4, 21% C_2H_6, 9% N_2. Experience in using various fuels in power plants of this firm show that additional processing charges are involved. These are:

(1) Pulverizing and handling cost for coal in cents per ton $= 6.20^{0.5}$.

(2) Atomizing and preheating cost for oil in cents per gallon $= 0.0015\ S_o \left(\frac{t_h}{3 + S_o}\right)^{1.5}$.

where: C = percentage carbon in the coal, S_o = specific gravity at 60° F, t_h = °F, to which oil must be heated to reduce viscosity to 0.15 lb. per ft. sec., and μ = viscosity of oil in lb. per ft. sec.

Using the above data, show which fuel to specify.

2. A pump in a soap plant handles, 150 g.p.m. of olive oil at 60° F. It takes the olive oil from a large storage tank, elevates it to a height of 100 ft. through a 2 inch standard pipe 200 ft. long and discharges it into a blow case, held at 50 pounds per sq. in. gauge pressure. What is the theoretical power requirement? An operator proposes to heat the oil to 150° F. to save power. If power costs 1 cent per horse-power hour, the pump is 50% efficient and steam costs 40 cents per million B.T.U., what will be the net saving or loss of such a change in $ per year. Assume day equals 24 hours, year equals 365 days, density independent of temperature, no heat loss, sp. g. equals .92, C_p equals 0.5 B.T.U. per lb. per °F. Assume flow is safely turbulent in first case and there is no cost of exchanger. Viscosity at 60° F. is 150 centipoises, at 150° F. 14 centipoises.

3. A mixture of gases and vapors of light and heavy tars is to be cooled in a tubular heat exchanger from an initial temperature of 250° F. To prevent deposition of heavy tars on the tubes the metal temperature of the tubes must be kept above 215° F. What cooling medium would you use to meet these conditions economically?

4. The film coefficient for heat loss from a bare 1½" pipe (I.D. 1.61", O.D. 1.90") is estimated to be 3.2 B.T.U. per hour sq. ft. °F. Hot water under pressure of 67.01 p.s.i.a. is at a temperature of 300° F. and has a viscosity of 0.13 centipoise, a thermal conductivity of 0.396 and a density of 57.42 pounds per cu. ft. The water flows at a rate of 0.75 ft. per sec. through 175 ft. of pipe. Estimate the fall in temperature of the water assuming surroundings to be air at 50° F. Estimate the fall in temperature if the pipe is lagged with 85% magnesia pipe covering 1¼" thick, k — 0.04, when the film coefficient from the lagging to surrounding air is estimated to be 2.8 B.T.U. per hr., sq. ft., °F.

5. A steam pipe carrying steam at 40 lbs. gage pressure for a distance of 400 feet in a chemical plant is not insulated. Estimate the savings in steam cost that could be made per year if this 3 inch steam line were covered with 85% magnesia pipe covering 2" thick. Take the room temperature to be 80° F, the cost of steam 30 cents per 1000 pounds.

6. Outline the safety requirements and safety equipment for one of the following industries:

(a) Electrolytic caustic and chlorine.

(b) Petroleum refining.

(c) Explosives manufacture.

7. The chemical reaction equilibrium constant for the reaction

$$1/2\ N_2 + 3/2\ H_2 = NH_3$$

is given as follows:

$$\text{Log}_{10} K_1 = \frac{4880}{T} - 5.88$$

How much NH_3 would be formed from a mixture of 20 mols of N_2, 60 mols of H_2, and 20 mols of inert gas at a pressure of 400 atm. and a temperature of 850 F. if the reaction time is sufficiently long to allow static equilibrium to be reached?

8. The pressure equation generally used in coal mine ventilation is variously written

$$P = \frac{KSV^2}{A} \text{ or } \frac{KLOV^2}{A} \text{ or } \frac{KLOQ^2}{A^3}$$

(a) List all the factors which are lumped together in "K" in the above equation.

(b) Will this equation give consistent and true results when applied to a mine such as at Butte, Montana, for example, where at a depth of 4000 feet the rock temperature is about 120 F. and the relative humidity is near 100%. Explain your answer to (b).

Group C

1. With the alignment data given below, compute all curve data and deflection angles in order to stake out compound reverse curves, using railroad or highway curve tables. Should either of the curves be staked with 50′ cords? If so, show in your deflection angles.

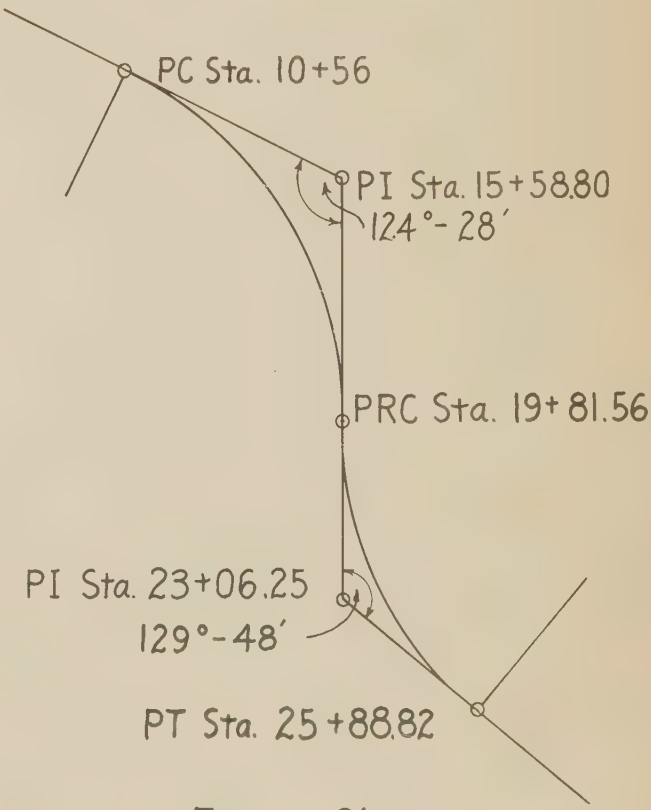


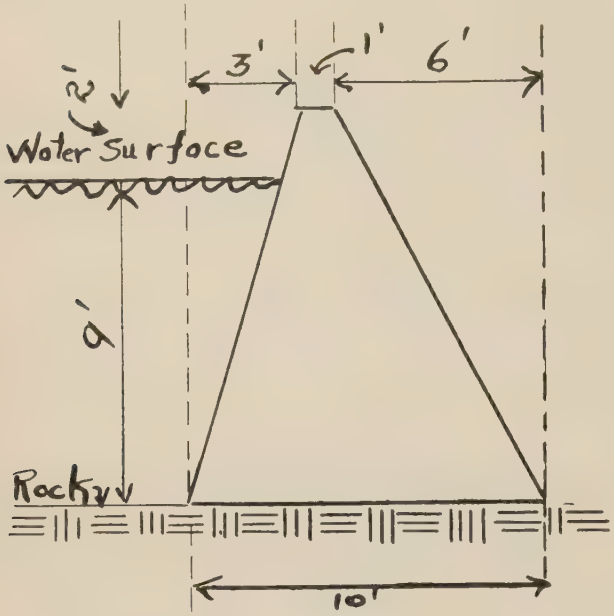
Figure C1

2. Show the resultant of all forces acting upon the non-overflow gravity section of the dam.

Is the section safe against overturning?

Is the upstream face of the masonry free of tension?

Graphical solution may be accepted.



SECTION THROUGH
NON-OVERFLOW GRAVITY DAM
Note: Assume masonry to weigh 150 lbs. per cu. ft.
Note: Assume foundation rock and construction joints tight and ignore hydrostatic uplift.

Figure C2

3. Given a smooth reinforced concrete lined channel as shown below in cross-section.

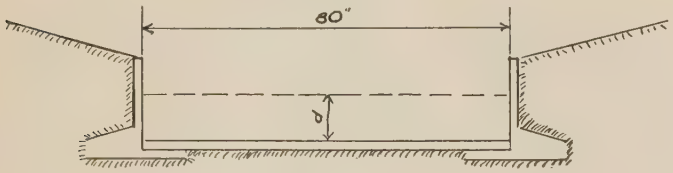


Figure C3

Determine the slope on which this channel section could be built and the depth of flow so that it will discharge 20,000 cfs. at a velocity equal to 80% of the critical velocity.

4. From the following field notes on a road embankment job, find the quantity of earth work from Station 14 to Station 15. The base of the road is 40 feet and the slope are 1½ to 1.

Sta. 15	32.0		+ 4.2		28.4
	+ 8.0				+ 5.6
Sta. 14 + 60	35.0	20.0	+ 4.0	20.0	29.0
	+ 10.0	+ 4.5		+ 7.5	+ 6.0
Sta. 14	27.5		+ 6.0		31.4
	+ 5.0				+ 7.6

5. From the accompanying grid sheet showing elevations at intervals of 50', and also intermediate elevations, prepare a contour map with a vertical interval of 2'.

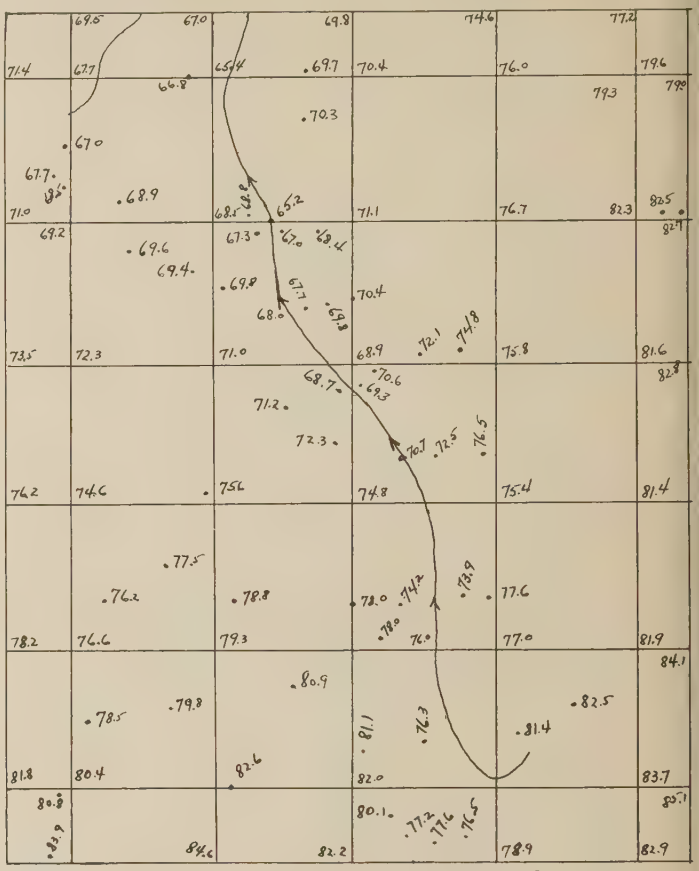


Figure C5

6. What horse power is required at the input shaft of the centrifugal pump when the pumping rate is 1000 gallons per minute? (Show all steps of your computations.)

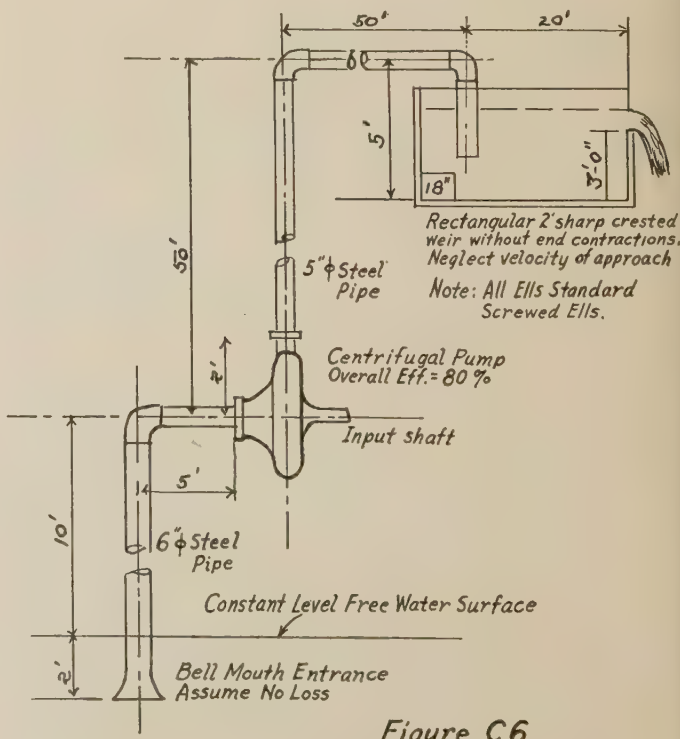


Figure C6

7. The average monthly rate of flow in cubic feet per second in the Raquette River at Piercefield, for the year 1913, was: January 2190, February 1540, March 2170, April 4600, May 1240, June 1190, July 474, August 220, September 101, October 411, November 1260, December 1220.

(a) What would be the necessary storage capacity in acre-feet for a reservoir on the stream to insure a continuous flow of 500 cubic feet per second throughout the year?

(b) When will the reservoir be filled after the summer season?

(c) When will it be empty?

8. A beam is continuous over three spans of 30 feet, 40 feet and 30 feet with its outer ends freely supported. It is to support a uniformly distributed dead load of 1200 lbs. per linear foot and will be subjected to movable uniform live load of 2400 lbs. per linear foot which can cover any part or parts of the total length.

(a) Draw the dead load moment diagram giving maximum ordinates.

(b) Calculate the location and value of the maximum positive moment in the first span.

(c) Calculate the value of the greatest negative moment that can be produced in the beam. Where does it occur?

Group D

1. A 3-phase 50,000-KVA, 13,200-volt, 60-cycle generator is connected to a 13,200-volt bus. Other generators connected to the same bus hold the bus voltage and frequency constant.

The generator has a synchronous reactance of 1.0 per unit and is delivering one-half its rated kva at unity power factor. Neglect armature resistance and magnetic saturation and determine the (a) real power, (b) the reactive kilovars, and (c) the total kva if the excitation is increased 50 per cent without changing the input to the prime mover.

2. A Thyratron is to be used in a grid-controlled rectifier circuit in which it is desired to control the DC load current from zero to the maximum available. If the starting, maintaining, and cut-off voltages are taken as E_o and the critical grid voltage curve is assumed to be zero:

(a) Sketch a schematic diagram which will meet the specifications.

(b) Sketch oscillograms of the plate supply voltage, grid control voltage and critical grid voltage curve in the proper phase relationship.

3. Three delta-connected impedances each consisting of 30 ohms resistance and 30 ohms inductive reactance are connected in parallel with a set of three wye-connected impedances each consisting of 10 ohms resistance and 10 ohms capacitive reactance. If the line-to-line voltage impressed on this system of impedance is 240 volts, three-phase find:

(a) Line current.

(b) Total power.

(c) Reactive power.

(d) Power factor.

4. A triode is operated as an amplifier with a load consisting of 60,000 ohms resistance shunted by 500 mmf capacitance. If the characteristics of the triode are $\mu = 40$ and $r_p = 20{,}000$ ohms, find:

(a) The voltage gain at low frequencies.

(b) The upper half-power frequency.

(c) The complex gain at the upper half-power frequency.

5. A new three phase power load of 3000 kva at 0.9 power factor is to be located 10 miles from a bulk power source. It is expected that the load will not increase for an indefinite period, and the location is such that duplicate supply is impractical.

(a) Select a standard receiving-end voltage and a copper conductor size to limit the regulation to 5 per cent. The equivalent spacing of the line is assumed to be 5 feet, and approximate formulas for regulation are sufficiently accurate.

(b) In view of the conditions stated, outline very briefly what practical considerations might affect the physical and electrical design of the line.

6. A communication transmission line has a characteristic impedance Z_o of 400 ohms and is 0.15 meters in length. The line is short-circuited at one end. The altenuation constant, α, is 0.2 neper per meter.

(a) What value of capacitance must be connected across th open end of the line in order that the combination will be resonant at 300 megacycles per second?

(b) What is the Q of the combination if the loss in the capacitor is neglected?

7. A manufacturing plant served by a 2400/4160-volt, three-phase, 60-cycle, 4- wire distribution circuit has an induction motor load of 1500 kw at a power factor of 0.6. Determine the total kva and microfarads of 2400 volt capacitors required to correct the power factor of this load to unity.

8. A circuit consisting of unknown resistance, inductance and capacitance elements in series is connected to a variable-frequency oscillator whose voltage is maintained constant at 15 volts. At a frequency of 1000 c.p.s. the current is a maximum at 10 milliamperes, but at 2000 c.p.s. the current decreases to 1.0 milliamperes. Find the resistance, inductance and capacitance of this circuit.

Group E

1. A test of an oil-fired furnace gave an actual evaporation of 13 lb. water per lb. oil with boiler, furnace, and superheater efficiency of 80 per cent. The boiler pressure 200 lbs. abs., superheat 100° F, and feed water temperature 162° F. Find heating value of fuel.

2. The steam pressure in the cylinder of a steam engine is 100 p.s.i. The piston is 10 in. in dia. and the piston rod is 1 in. in dia. (See Fig. E-2)

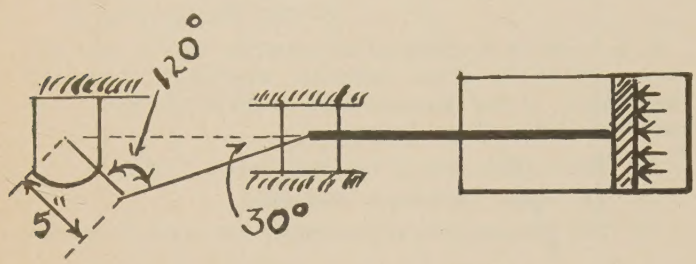


Figure E2

Find

(a) The stress in the piston rod in lbs. per in.^{2}.

(b) Find the compressive stress in the connecting rod for the configuration shown. The cross sectional area of the connecting rod is 2 sq. in.

(c) Find the torque in inch pounds in the crank shaft for the configuration shown.

3. Two pieces of 18-8 stainless steel containing 0.12 per cent carbon were welded together. The steel part thus formed was put into use, and it was found that two narrow regions on either side of the weld corroded in a relatively short time while the remainder of the part, including the weld itself, was essentially unaffected. Explain the reason for this rapid, localized corrosion, and suggest a method for avoiding this difficulty.

4. A centrifugal pump located 10 feet above a river discharges 1000 gallons of water per minute against a pressure head of 100 lb. per sq. in. Assume an overall efficiency of 50 per cent. Calculate the cost of electrical power per day of 24 hours at 2 cents per k.w. hour.

5. A boiler is to be equipped with an air heater and the following guarantees are made:

Boiler output yearly average	80,000 lb. per hour
Steam pressure	300 lb. abs.
Steam temperature	700° F
Feed-water temperature	212° F
Overall efficiency when equipped with an air heater	83%
Heating value of coal as fired, average	14,200 b.t.u. per pound
Flue gas temperature from boiler	750° F
Expected gas temperature from air heater	350° F
Cost of air heater installed	$12,000
Cost of coal delivered in bunkers	$5.00 per ton
Pounds of gas per pound of coal at 30% excess air	13.8

(a) What will be the yearly fuel cost?

(b) What percentages of fuel cost can be saved by installation of the air heater?

6. In the gear train shown in Fig. E-6, the driving shaft A is transmitting 5 H.P. at a speed of 400 R.P.M. Determine the torque in in. lb. acting on shaft K.

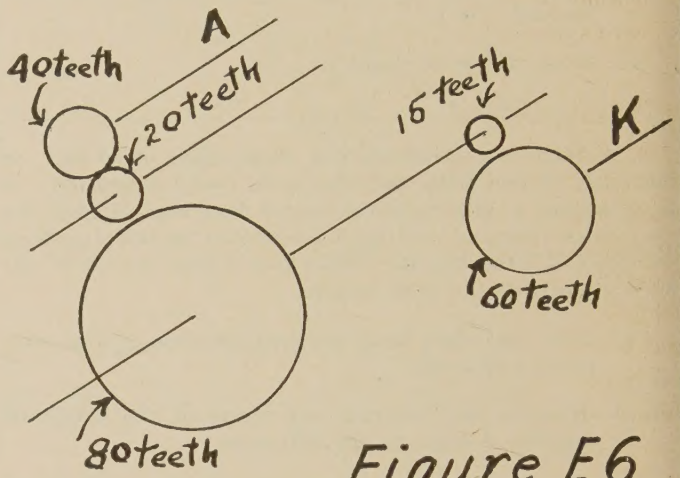


Figure E6

7. A fan is delivering 12,000 CFM at a static pressure of 1¼ in., speed 420 R.P.M. and taking 4 H.P. It is desired to increase the fan output to 15,000 CFM. What would be the speed, horsepower, and static pressure for the increased output?

8. In the New York Times, it was reported that a 24-in. i.d. pipe line for the transportation of 300,000 bbl./day (42 gal./bbl.) of crude oil was in the process of construction from Longview, Texas, to the East Coast, a distance of 1388 miles. The account stated that the oil was to be moved by centrifugal pumps spaced at approximately equal intervals along the line. Each pump was to be driven by a 1500 hp. electric motor.

On the basis of the following assumptions, calculate:

(a) The number of pump-motor sets required

(b) The average distance, in miles, between pumps

(c) The discharge pressure of each pump, in lb./sq. in. gage

(d) The power cost, in cents per bbl. of crude oil delivered.

Assumptions:

Pressure drop due to bends, valves and differences in elevation are negligible.

Sp. gr. of crude oil at line temperature = 0.87.

Viscosity of crude oil at line temperature = 10 centipoises

Motor efficiency = 95 per cent

Pump efficiency = 75 per cent

Suction pressure on each pump = 0 lb./sq. in. gage

Power cost = 0.5 cents/Kw.hr.

Chicago Chapter News

President Spicer

Our Chapter was fortunate to have President A. Douglas Spicer of the State Society as speaker at our last meeting. Those who were present were apprised of several historical facts about our Society not generally known and of interest to members.

Obituary

We regret to report the death of Richard Gnaedinger, a brother of our member John, and wish to extend the sincere sympathy of the Chapter to John and his family.

Did You Hear That —

Frank Edwards has been nominated as President of Illinois Section — A.S.C.E. A new committee has been formed at the State level to appraise the Society and make recommendations for increasing membership and to make our Society of greater benefit to its members? You have some ideas in this regard? Well that's fine for Chicago Chapter Representative, Hal. Sommerschield, has been made Chairman of this Committee and he would be happy to have you communicate any suggestions to him.

Amendment

Something should be said regarding the recent presentation of the above question in ILLINOIS ENGINEER last month. It may appear that some Chicago Chapter members had betrayed the intent of the proposed amendment. This is certainly not so.

It was hoped that by withdrawing signatures to the original petition, the consideration of the matter could be delayed until the criticisms of the Constitutional Amendment Committee had been properly studied and adjustments made to the Proposed Amendment.

It is now deemed necessary to pass the Amendment, as is, and make adjustments later. This will explain why your Executive Committee contacted you regarding approval of the Amendment.

Meeting Attendance

Those of you who have not attended recent meetings are missing a treat. We have had some exceptionally good speakers and the fellowship has been inspiring. There is little doubt that we are all anxious to see our Society extend its effect on the profession. The time when this effect will be felt will be hastened if every member cooperates in the activity of the Chapter. You will benefit personally in proportion to the effort you expend. Why sit on the outer fringe and bemoan the fact that the society does little for you? Why not enter into the activity and provide the Society with the benefit of your ideas and effort? A start in the right direction can be made by attendance at our next meeting. Your officers covet your attendance and cooperation.

We have no more right to consume happiness without producing it than we have to consume wealth without producing it.—Shaw's *Candida*.

Engineering Societies Personnel Service, Inc.

New York Chicago Detroit San Francisco
84 East Randolph Street, Chicago 1, Ill. STate 2-2748

These items are from information furnished by the Engineering Societies Personnel Service, Inc., Chicago. This SERVICE is operated on a co-operative non-profit basis by the Illinois Society of Professional Engineers, and the national societies of Civil, Electrical, Mechanical and Mining and Metallurgical Engineers. Apply to ESPS, Chicago and the key number indicated. Prepared ENGINEERS AVAILABLE advertisements limited to 40 words, with typed resumé attached may be submitted to ESPS Chicago by members of the Illinois Society of Professional Engineers at no charge.
If placed in a position as a result of an Engineers Available or Position Available advertisement, applicants agree to pay the established placement fee. These rates are available on request and are sufficient to maintain an effective non-profit personnel service. A weekly bulletin of positions open is available to subscribers. Apply E. S. P. S., Chicago.

OVER THE MANAGER'S DESK

Colored leaves, football, and Hallowe-en! This is the season that begins to make us feel like getting back to work again in no uncertain terms. Now is the time to call or write E.S.P.S. for that Engineer you are looking for. If you have been thinking of seeking new employment as an engineer, this is the time of year to get registered with us. We have good men and good positions in our files. Let us not be ghostly about it, so why not make contact in the flesh and let us help you? B. H. A.

MEN AVAILABLE

Structural Designer, M.S.C.E., 29. Sixteen mos. struct. design work reinforced concrete, power plants, and steel mills. Thirty-two months structural design public utilities. Chicago. $6900. 481-PE

Mining Eng., Min. Engr., 24. Fourteen mos. Drafts. layout of steel plants and design of equipment. Six mos. laying and maintenance of track in quarry. U. S. $5100. 482-PE

Chief Engr., A.E.-Str. Engr., 43. Three and one half yrs. sales mgr. consulting services. Two yrs. designing component parts of trip mill converter building, and railroad repair shops. $10,400. Midwest. 483-PE

Sales Engr., M.E., 30. Thirty mos. in charge of layout, purchasing and checking of offset plates, shipping and inventory control. Two yrs. Prod. Mgmt. trainee. $6000. Chicago. 484-PE

Chem. Engr., Chem. Engr., 27. Six months in charge of production for a soap manuf. $4300. Chicago. 485-PE

Ind. Mgmt. Engr., E.E., 27. Twenty mos. field engr., on new sig. corps equip. Two yrs. Methods and processing on communications equipment. Sixteen mos. setting time study rates on radio, refrigerator. $6000. U. S. 486-PE

Plant Engr., E.E., 32. Five yrs. staff engr., providing information for estimates, design, ordering material, and some field checks. Eleven mos. Quality Control Engr., doing spot inspections of telephone equip. $6000. Midwest. 487-PE

Prod. Mgr., 39. Fifteen mos. director labor standards, incentives & methods. Five yrs. responsible for maint. of bldgs. One yr. and one half industrial engr., supervising payroll. Two yrs. Time Study Work. $6500. Chicago. 488-PE

Ind. Mgmt. Engr., I.A., 28. Fifteen mos. Sr. Indust. Engr. doing time study, layout, methods, and material control. Twenty-eight mos. standards on printing and bindery equipment, developed data into wage plans and set rates. Chicago. $5000. 489-PE

Constr. Supt., 27. Eleven mos. general supt. charge of constr. on schools. Two yrs. structural designer hydro-electric plants. One yr. as form erection engr. and sold forms. $7200. Chicago. 490-PE

Constr. Supt., D.S.S.-Arch., 31. Three yrs. Arch. designer doing designing, detailing, delineating, and general and sub contractor work. $5200. Midwest. 491-PE

Architect, 49. Thirteen yrs. Architect, doing general architectural work, some consulting, commercial, industrial and residential work. $8500. Chicago. 492-PE

POSITIONS AVAILABLE

Project Engineer, M.E. 10 years plus exp. in design of machine tools, Knowledge of detailed machine tool operations. Special tool design, processing, and welding. Duties: project work modernizing entire line of pumps, compressors and auxiliary equipment. Will be liaison between research engineering and manufacturing to develop the best and most economical line produced by best methods for a manufacturer of pumps. Salary: up to $8000. Location: Chicago. R-9312

Plant Maintenance, M.E. & E.E.. Age: 25-40. 2 years plus exp. in maintenance of automatic equipment, conveyors and electrical equipment. Duties: supervise maintenance program for paper converting company. For a manufacturer. Salary: $7200 per year. Employer may negotiate fee. Location: Chicago. R-9311

Sales Engineer—some technical training. Duties: sales engineering and sales promotional work for manufacturer of power plant equipment, valves and fittings. 1 man for Chicago area, and 1 for Iowa. Salary: Salary and expenses and car. R-9310

Designer, M.E. Degree or equiv. Age: 30 to 45. 5 years exp. in the design of heavy duty off the road drive axles. Knowledge of axles. Knowledge of axle manufacturing procedures. Duties: design and development of off the road drive axles following through the actual production. For a manufacturer of tractors. Salary: $5500 plus. Employer will pay fee. Location: Illinois. R-9309

Industrial Salesman, Grad or Equiv. Age to 38. Some exp. in territorial sales and some familiarity with territory involved and a proven sales record. Will be resp. to sales mgr. in Calif. for mfgrer. of equipt. for aircraft air conditioning and power plant systems. Must be good organizer. Free to travel and have pleasing personality. Territory includes Ohio, Western Penn., Ind., Mich., Ill. Salary: $7000-$10,000 plus expenses. R-9308

Hydraulics Engr., B.S., M.S., Ph.D. Age: to 35. Civil or Mech. with major Fluid Mech. Consider candidates without exp. Some knowl. research techniques gained thru indepen. invest. as: thesis work for univ. degree. Desire creative ability. Knowledge of constr. of experimental apparatus opera. of pile plant equip. & underst'g of mech. principles. Duties: Applied indus. research. Work involves translating of research results into pilot plant and prod. installations. Also requires abil. to analyze problems and apply basic prin. of math, mechanics & chem. engrg. to indus. process and product develop. Salary: to $500. Location: Wisconsin. T-9307

Draftsmen. 2 years plus exp. in drafting refinery construction work. Knowledge: pressure and piping codes. Duties: drafting on refinery projects. Salary: $2.00-$3.25 per hour. Location: Calumet District. Employer might negotiate the fee. R-9306(b)

Construction Eng. 5 yrs. plus exp. in refinery engineering or refinery constr. Know: refinery processes and piping. Duties: project engineer in complete charge of refinery engineering group. Salary: $164 a wk. Location: Calumet District. Employer might negotiate the fee. R-9306(a)

Shop Superintendent, M.E. Age: up to 45. 8 years in practical machine shop methods and supervisory work. Knowledge of methods and machine shop operations. Duties: supervise and operate machine shop making cutting tools, bearings, etc. About 100 employees. Must be able to do the work himself as well as lead others. For a manufacturer of cutting tools. Salary: $8000 per year. Location: Wisconsin. T-9304